SDSS II Supernovae with BOSS Host-redshift

Heather Campbell

Thanks to my collaborators:
Bob Nichol, Hubert Lampeitl,
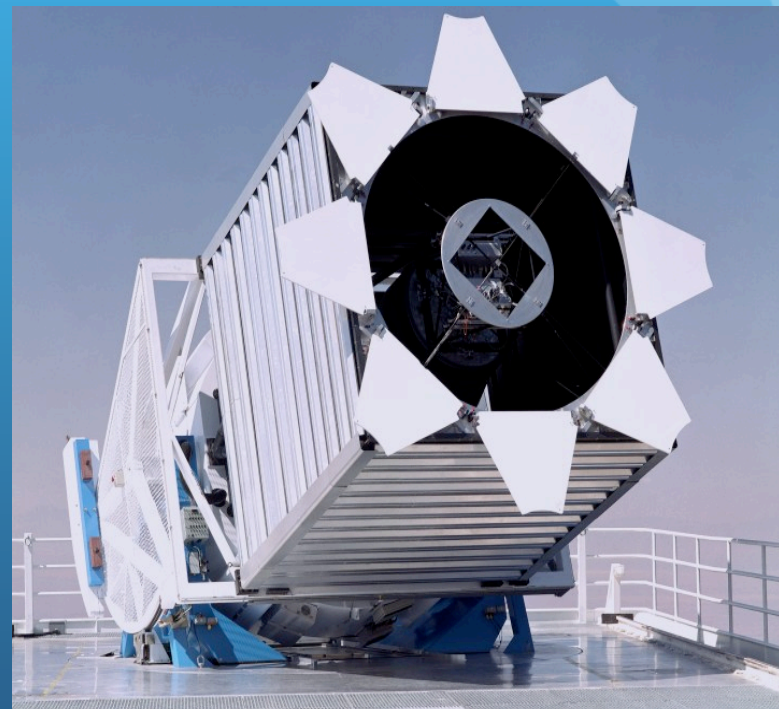Mat Smith and all the team

Plan

- SALT2

- False Discovery Rate

- Hubble Diagram

- Work in progress: Cosmological Constraints

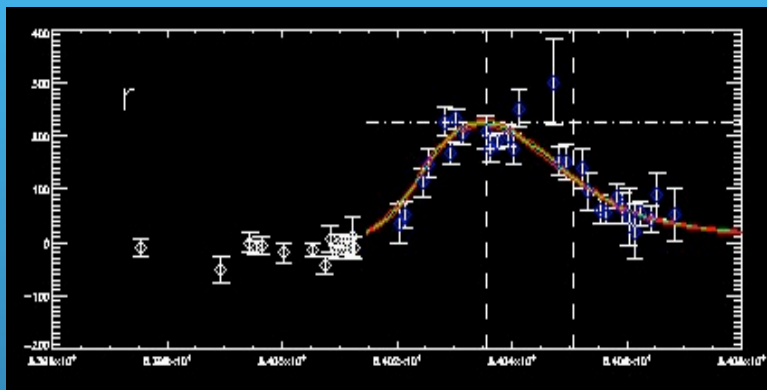- Work in progress: Bias testing

- Summary and further work

SALT2

- 658 SN host galaxies with accurate redshifts

- Plug all into SALT2 to fit the light curve

- 580 ran successfully through SALT2
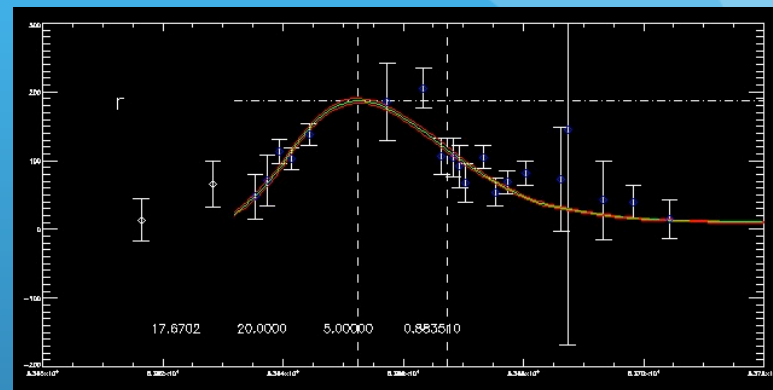
- 78 failed to be fitted by SALT2
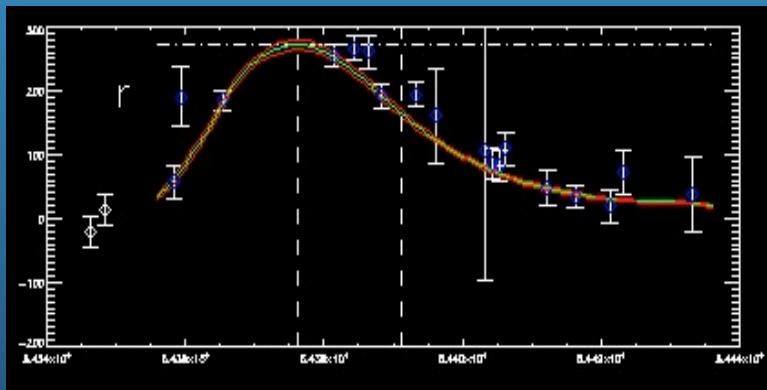
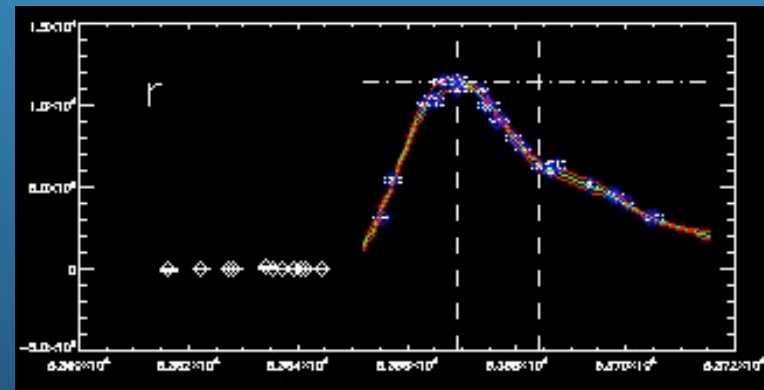# Examples of light curves: fitted with SALT2
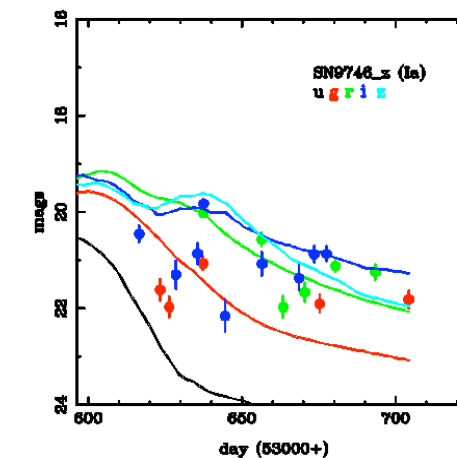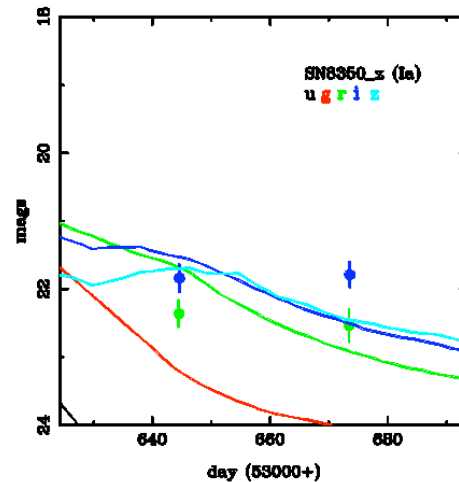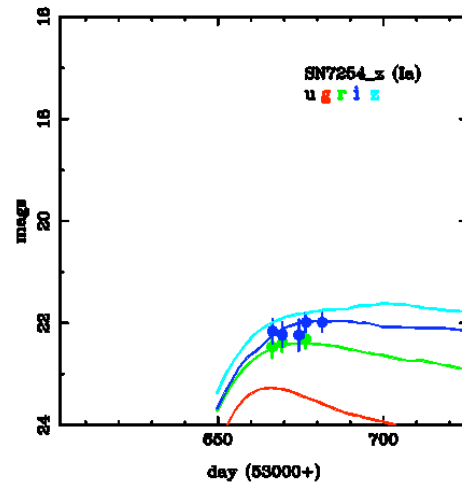
α = 0.1
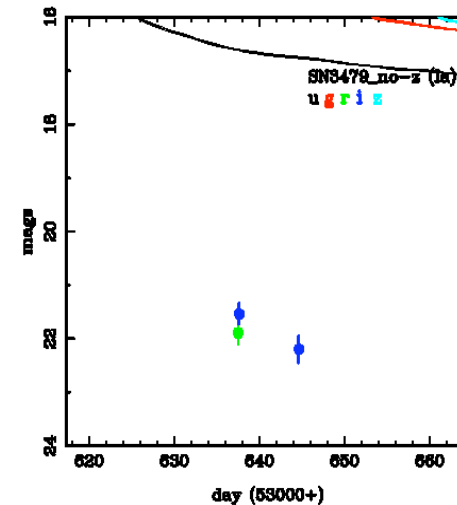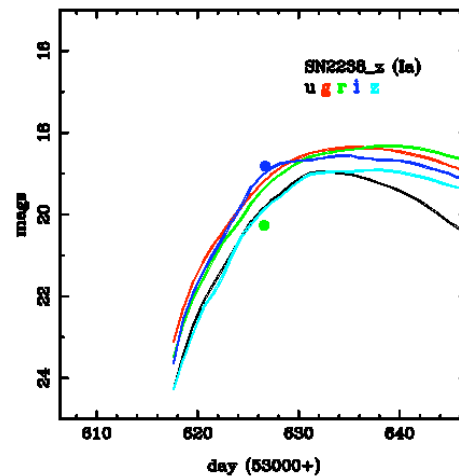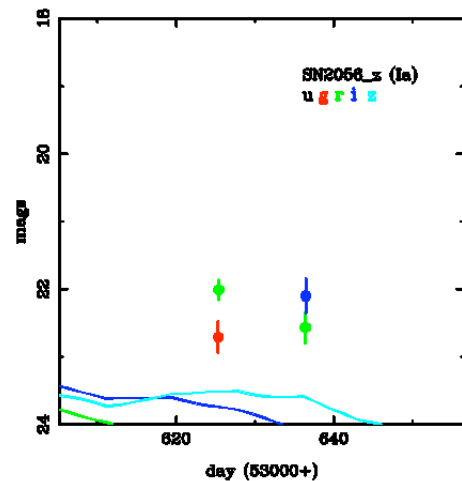B = 2.77

Z=0.3961

Z=0.4893

Z=0.3319

Z=0.0495

Examples of light curves:
78 failed SALT2

False Discovery Rate (FDR)

Miller et al. 2001

- Adaptively control the number of false discoveries (fraction of false rejections made over the total number of rejections performed) made when conducting multiple hypothesis tests.

- Left of line are rejected

$$\text{FDR} = \frac{N^{\text{reject}}_{\text{null true}}}{N^{\text{reject}}} = \frac{N^{\text{reject}}_{\text{null true}}}{N^{\text{reject}}_{\text{null true}} + N^{\text{reject}}_{\text{null false}}},$$

$$\langle \text{FDR} \rangle \le \alpha.$$
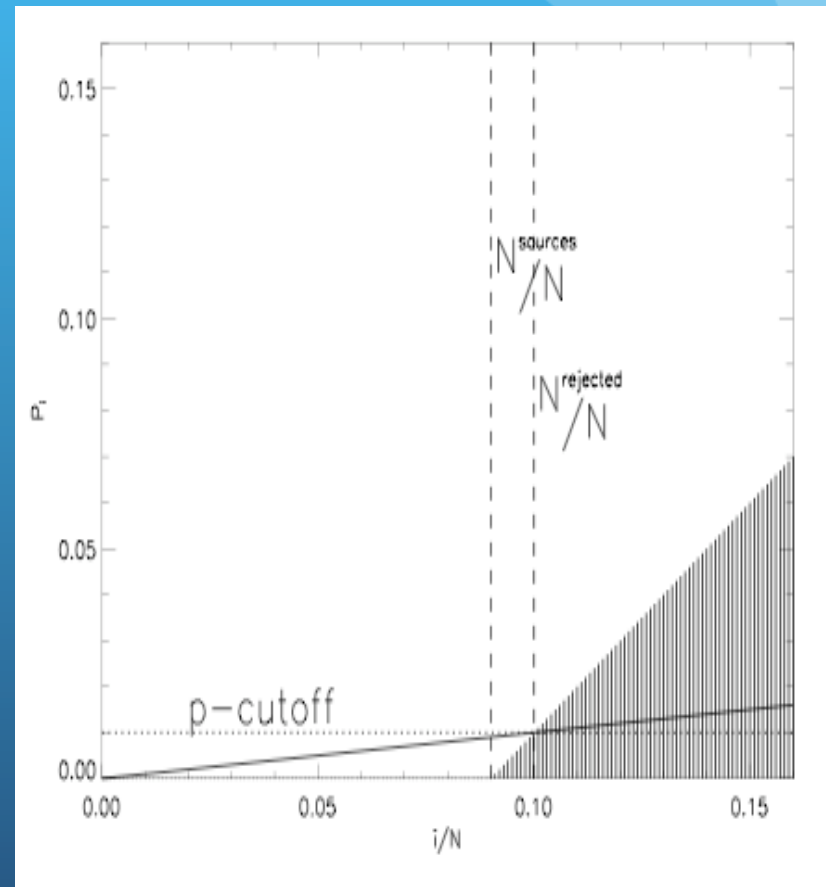
Hubble Diagram 1

SDSS II spectral sample

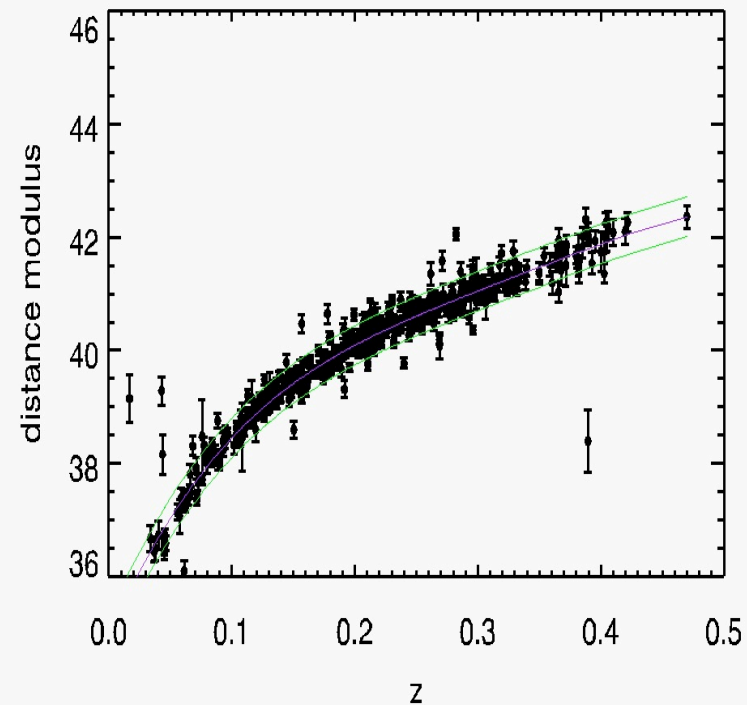- Plotted a Hubble diagram of the confirmed type Ia for SDSS II and fitted a 4th order polynomial to it.

- Overlaid this line on all the spectrally classified data.

- Used False Discovery Rate to remove SN with a low probability of belonging to the Ia distribution.

Hubble Diagram 2

All BOSS first year

- Distance modulus calculated for 580 supernovae, which ran through SALT2.

- Put all on Hubble Diagram ignoring type.

- Overlaid polynomial line from spectral type Ia on the unclassified BOSS data.
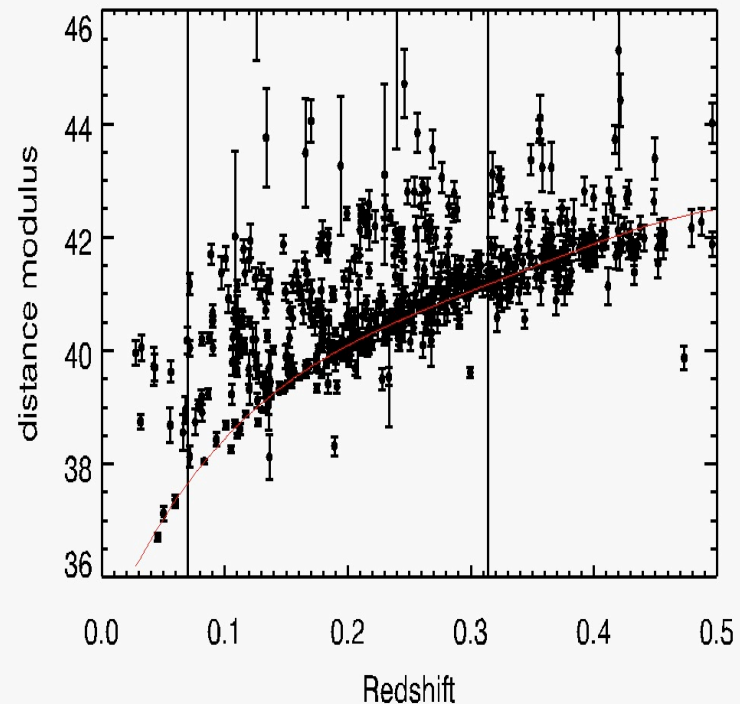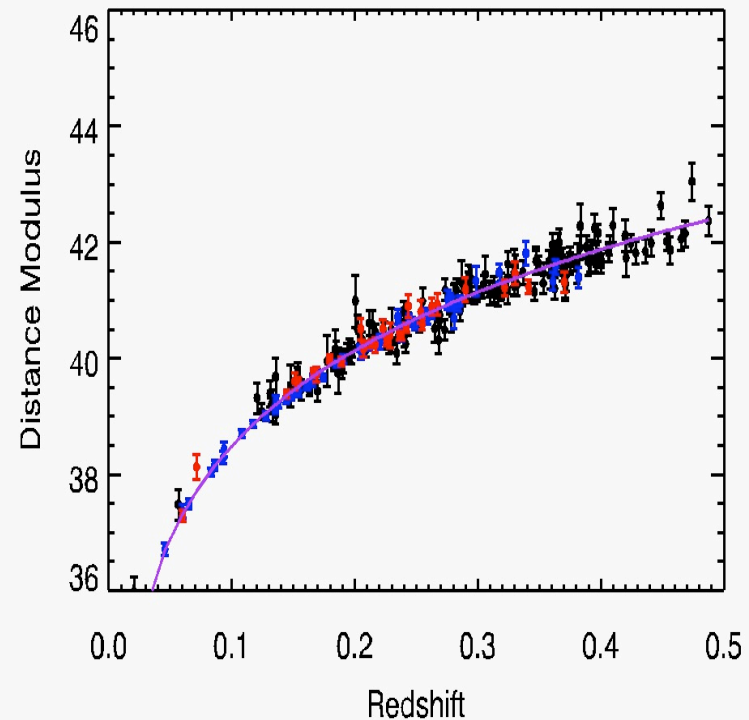
Hubble Diagram 3

BOSS first year –Type Ia

- Used False Discovery Rate to remove SN with a low probability of belonging to the Ia distribution.

- New Hubble diagram of 235 SN with host redshifts

Blue = spec Ia = 52
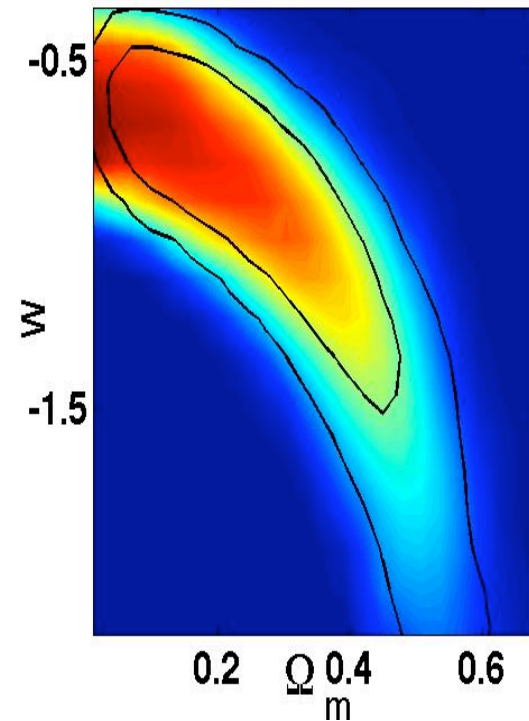Red = already had host spectra = 30
Black = new = 153

Work in progress: Cosmological Constraints

BOSS 235 SN Ia fitted in cosmomc

- Using **Cosmological MonteCarlo (COSMOMC)**

- Fortran 90 Markov-Chain Monte-Carlo (MCMC) engine for exploring cosmological parameter space

- Just this new data

- In future: use in combination with other probes. (BAO, WMAP etc)

68% and 95% confidence limits color-shaded regions show the mean likelihood of the sample

Work in progress: Cosmological Constraints

Lampeitl et al. 2009

- Using **Cosmological MonteCarlo (COSMOMC)**

- Fortran 90 Markov-Chain Monte-Carlo (MCMC) engine for exploring cosmological parameter space

- Just this new data

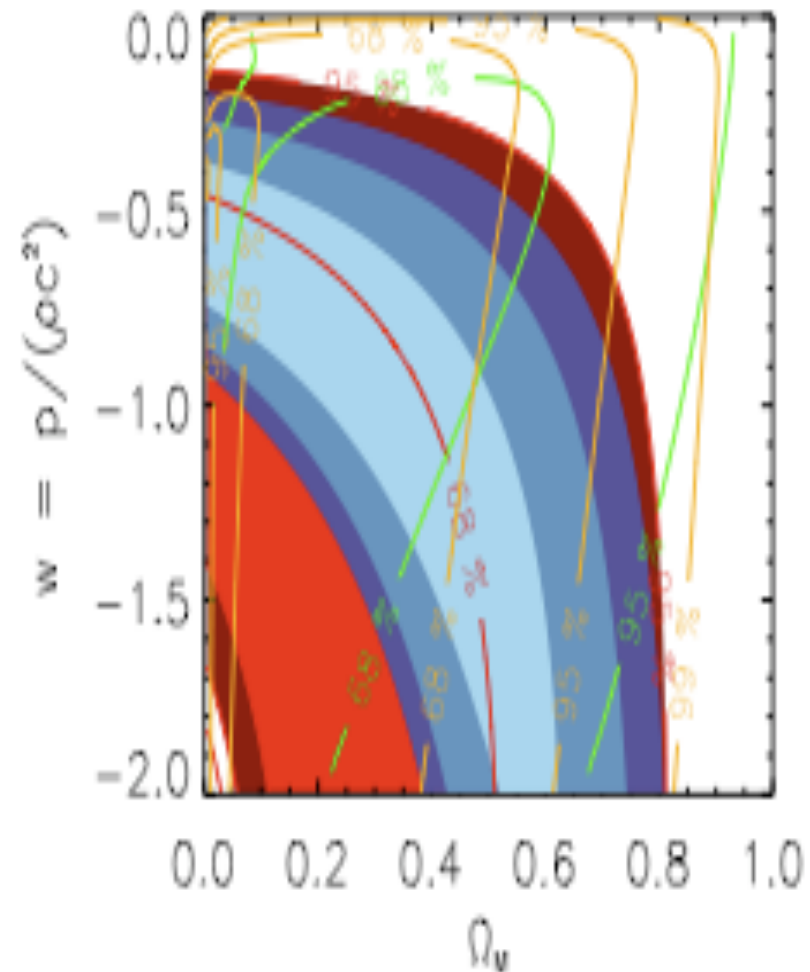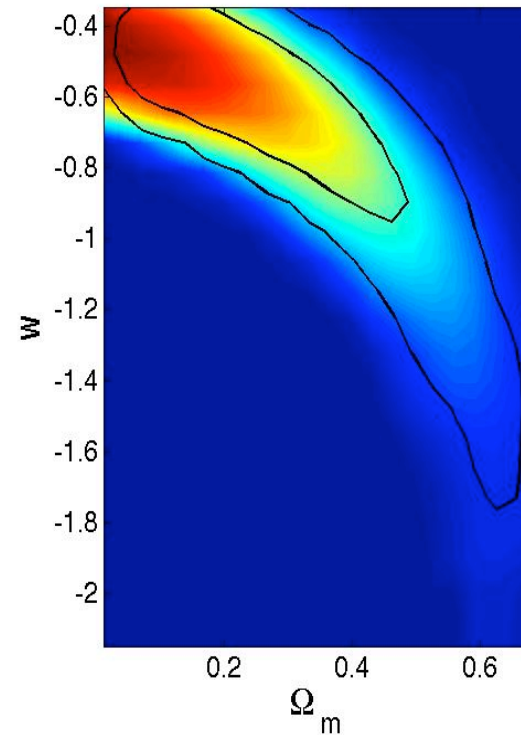- In future: use in combination with other probes. (BAO, WMAP etc)
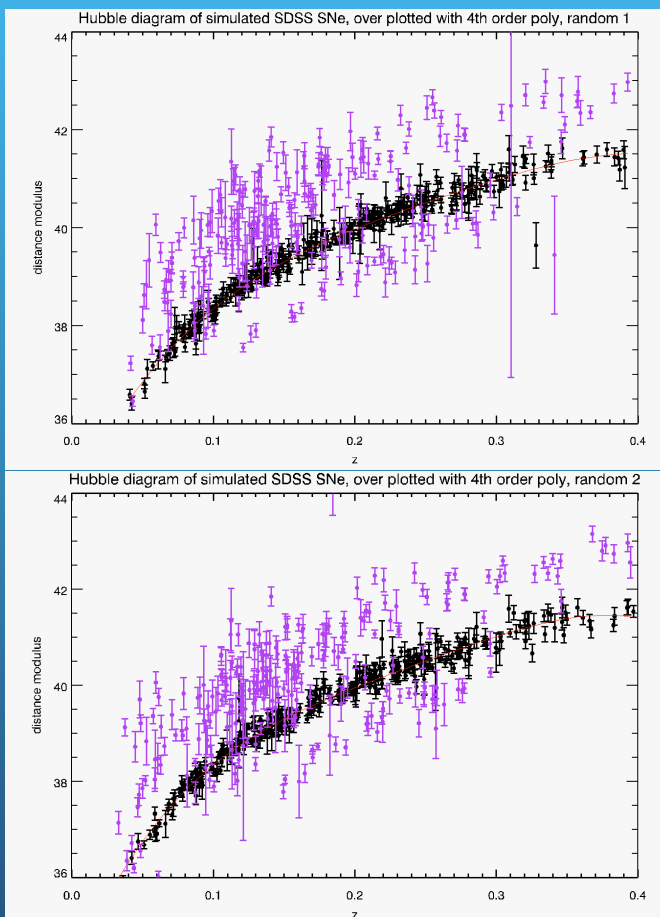
Work in progress: Bias testing

SDSS II spectrally confirmed

1) SDSS II spectrally confirmed

2) SDSS Simulations (Kessler)

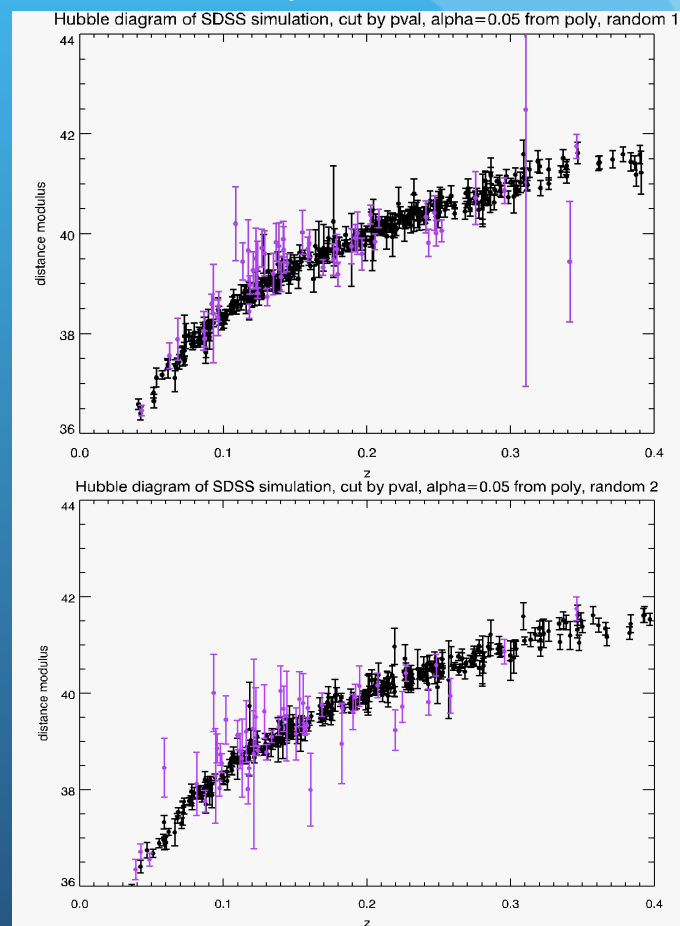- Comological analysis of Type Ia and compared to my cut on all supernovae

Bias – SDSS simulation
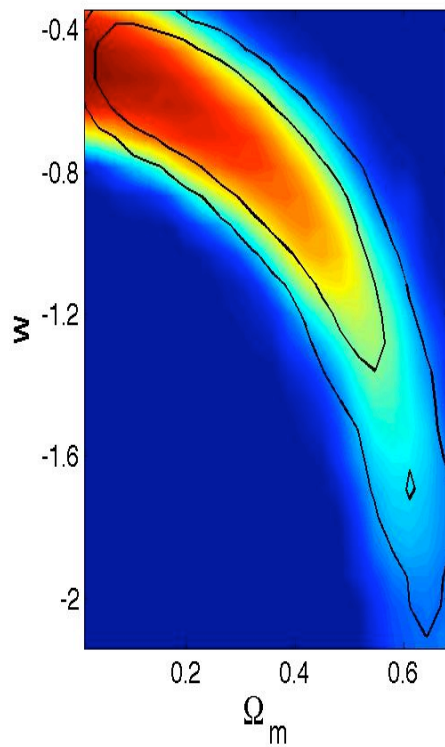
Random: type Ia plus not Ia
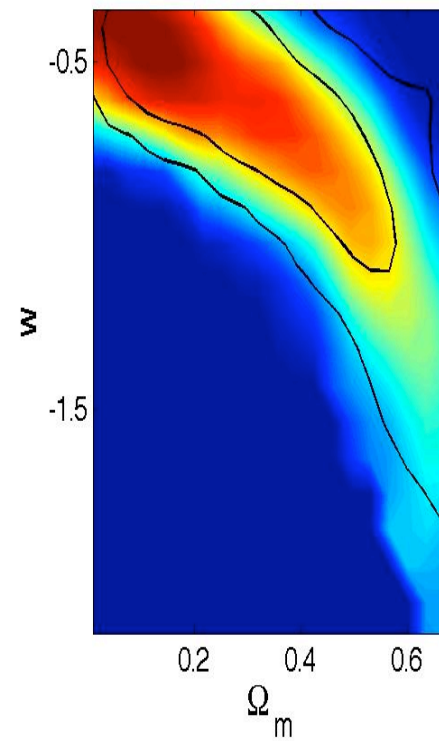
My classified Ia

Bias – SDSS simulation

Random 1: type Ia

My classified Ia

Summary

- 658 reliable Host galaxy redshifts

- New method for rejecting non Ia's, maybe useful for future surveys.

- New Hubble diagram with 235 SN Ia (52 spec Ia, 30 host spectra, 153 new)

Further Work

- All Host Galaxy Redshifts by the end of October!!

- Find the best fit cosmology

- Investigate the bias caused by the polynomial fit and look at alternative classification methods

- Paper of cosmological analysis next year